Property of Interplanetary dust in our solar system investigated from infrared spectroscopic observations

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Planets and their materials like dust have been thought to stay on the same orbit during the planets' formation. Recently, however, it was found that dust in protoplanetary disks were well mixed along the heliocentric direction. Once dust get close to the central star, they are heated, crystallized and evaporated. When they turn back to outwards, they will re-condense with a different cooling rate depending on the mixing speed and their properties will diverge. Since different mixing speeds result in capturing dust to planetesimals on different orbits, comets and asteroids, which are the survived planetesimals on outer and inner orbit respectively, can be composed by the dust of different properties. In the current solar system, comets and asteroids release interplanetary dust into the different distribution of ecliptic latitudes. Therefore, we aim to compare the properties of interplanetary dust among various ecliptic latitudes.

For this purpose, we focused on the spectral feature seen in the thermal emission of interplanetary dust, because the shape depends on the dust properties; Mg/Fe, olivine/pyroxene and crystal/amorphous ratio. We use mid-infrared spectroscopic data of zodiacal emission at 74 different directions obtained with AKARI/IRC. We have carefully examined and subtracted artifacts including scattered light in the detector and ghost caused by the bright sources in the field of view, and successfully obtained the high S/N spectra in 5 - 12 μm with R~50. After grouping their spectra depends on the ecliptic latitude and averaging in same ecliptic latitude bin, we fit the continuum to a diluted blackbody of a single temperature ($\tau B\nu(T)$) and divided the averaged spectra by the modeled continuum.

As a result, we detected the spectral feature around 10 μm in all ecliptic latitudes and recognized the variations in the shape and the strength of this feature among different ecliptic latitudes. We compared their shapes to absorption coefficient spectrum of some types of minerals derived from laboratory measurements and estimated the mineral composition of interplanetary dust. As the conclusion, we found that interplanetary dust has lower olivine/pyroxene ratio at higher ecliptic latitudes. We will present these results and talk about future works for more progressive discussion.